

Flow-off[®] - Multi-functional Fluid Migration Control Technology

1. System Description and Benefits

Flow-off not only exhibits applicable slurry properties in fluid loss control, rheology, thickening time, compressive strength and free water, but also shows great fluid migration control capacities due to minimal fluid loss, thin and tough filter cake, and right-angle set behavior. Synergistic interactions between fluid migration control agent, anti-corrosion agent, retarder and stabilizer makes Flow-off slurry a multi-functional oilwell cementing technology.

Characteristics	Benefits
Stable system	Fluid migration control capacity
Low fluid loss, thin and tough filter cake	
Right angle set cement	
Environmentally friendly Flow-off additives	
Anti-corrosion properties	
Low additive loading	Simple and low risk field operations and good cementing job quality
Applicable to wide temperature and density range	
Improvement of casing/cement/formation bonding	

2. Flow-off Additives

Product	Code	Form
Dispersant	KCM012L	Brownish Liquid
High Temperature Retarder	KCM026A	Brownish Liquid
Flow-off Additive	KCM028	White Liquid
Latex Stabilizer	KCM018A	Clear Yellow Liquid
Anti-corrosion Agent	KCM027	Gray Powder
Defoamer and Anti-foaming Agent	KCM043	White Emulsion

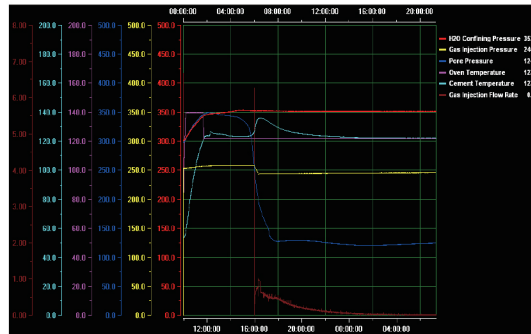
3. Typical Properties and Field Applications

Flow-off technology was commercialized in 2010 successfully and has been applied in various oil and gas fields in the world. It has been proved to be effective in cementing oil or gas wells with the following conditions and properties:

Temperature: BHST 150-302°F (65-150°C)
 Density: 10.5 ppg to 20.0 ppg (1.30 – 2.45 g/cm³)
 Mix-water: Fresh water, brines (up to 18%)
 Compressive strength: ≥15 MPa/24 hrs.
 API fluid loss: 15-30 mL

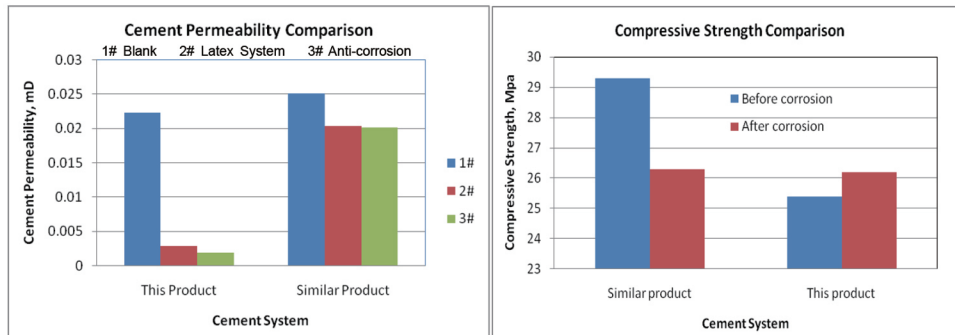
Further information about field jobs is described in documented “Case History of Flow-off Technology”.

Typical fluid migration control and anti-corrosion properties of Flow-off slurries are shown in the following Figures.



(1.89S.G, 120°C, 300psi Pore Pressure)

Experimental Results of Gas Migration Control



Anti-corrosion Performance

4. Precautions and HSE Considerations

Fluid migration control additive KCM028 is environmentally friendly and antifoaming. Migration control aid KCM027 improves slurry resistance to sour gas (H₂S and CO₂) corrosions. Dispersant KCM012L and retarder KCM026A are specifically selected to be compatible with KCM028 and KCM027.

The laboratory procedures, quality assurance program and guidelines for field mixing and handling of Flow-off systems are described in Flow-off fluid manual.

Refer to the technical sheet and SDS of the respective product for the health, safety and environmental information of each product.

Dispersant KCM012L

1. Introduction

Dispersants can improve mixability of cement slurry and reduce slurry viscosity. This will reduce pumping frictions and lower the critical rate for turbulence flow. Most dispersants achieve above objectives by separating solid particles and suspend them homogeneously in cement slurry. Many dispersing agents in cement slurry are also able to help improve fluid loss properties of the slurry.

2. Physical Properties and Hazards

Additives	Form	S.G.	Water Solubility	Flash Point (°C)	Health Hazard	Physical Hazard	pH (1% solution)
KCM012L	Brownish liquid	1.20-1.30	Soluble	>93	Eyes irritation	None	7.5 – 9.0

3. Chemical Properties and Application

As described above KCM012L provides cement slurry placement in turbulent flow easily and at minimal pumping pressure due to lower frictions, especially in applications of smaller tubulars and viscous slurry designs. Unique chemical nature of KCM012L will disperse solid particles effectively and stabilize them homogeneously in cement slurries to prevent any settling problems and reduce free water content.

4. Treatment

KCM012L is generally used at concentrations from 0.10 to 1.0%BWOC depending on the brands of cement and applications. Caution should be taken to “over-disperse” the slurry at higher KCM012L concentrations. Excess free water and particle settling will be observed if slurries are “over-dispersed”.

5. Packaging

This product is supplied in 55 gallons high density polyethylene (HDPE) drums. Keep it away from extreme conditions such as places near flames or direct sunlight.

Latex Stabilizer KCM018A

1. Introduction

Premature destabilization and “false-set” are sometimes encountered in Flow-off technologies for certain cement brands especially at high temperature. Stabilizer aid KCM018A is therefore developed to mitigate the problems described above.

KCM018A tends to slightly disperse Flow-off slurries mixed in fresh water thus facilitating the turbulent displacement techniques while maintaining proper slurry rheological properties.

2. Physical Properties and Hazards

Additives	Form	S.G.	Water Solubility	Melting/Flash Point (°C)	Health Hazard	Physical Hazard	pH (1% solution)
KCM018A	Clear yellow liquid	1.02-1.12	Soluble	>93	None	None	7-9

3. Chemical Properties and Application

KCM018A is applied in most Flow-off cement slurries to change the interaction mechanisms between latex and cement so that premature destabilization and gelation is minimized. It is effective in wide temperature (65-150°C) and density (10-20 lb/100ft³) ranges.

KCM018A does not affect other cement properties such as thickening time, compressive strength although it performs good latex stabilization and “right-angle set” cement properties.

4. Treatment

0.02-0.25 gal/sack loading is generally required depend on temperature, mixing water and slurry density.

5. Packaging

KCM018A is supplied in 5 gallons high density polyethylene (HDPE) drums.

Keep it away from extreme conditions such as places near flames or direct sunlight.

High Temperature Retarder KCM026A

1. Introduction

Hydration time and cement set period are critical for well cementing design. Retarders are generally utilized in cement slurry to control cement thickening time to reduce job risks especially at medium to high temperature applications.

Liquid form retarder aid KCM026A, either itself or together with other retarder products, provides accurate thickening time for medium to high temperature applications in oilwell cementing.

2. Physical Properties and Hazards

Additives	Form	S.G.	Flash Point (°C)	Health Hazard	Physical Hazard	pH
KCM026A	Brownish liquid	1.05-1.15	>93	Eyes	None	10-12

3. Chemical Properties and Application

KCM026A can be used to control cement thickening time at temperature 65-150°C and density 10.5-20 lbs/gal. The temperature limit can be extended to 400°F if used together with other retarders.

KCM026A has slight dispersing effect thus facilitating turbulent flow techniques.

KCM026A shows good compatibility in most cement slurries and approved to be tolerant to many factors such as mixing water (fresh, sea, and salt), concentration, shear, temperatures, and cement brands.

4. Treatment

Exact loading of KCM026A depend on additives used in cement slurry, typically 0.1-0.8 gal/sack KCM026A is required for temperature range of 65-150°C.

5. Packaging

KCM026A is supplied in 5 gallons high density polyethylene (HDPE) drums.

Keep it away from extreme conditions such as places near flames or direct sunlight.

Anti-corrosion Agent KCM027

1. Introduction

Typical Portland cement systems are not resistant to corrosive chemical environment such as CO₂ or H₂S bearing formations. Addition of KCM027 into cement systems will improve cement resistance to corrosive fluids. KCM027 tends to increase cement compressive strength and reduce slurry density as well.

2. Physical Properties and Hazards

Additives	Form	S.G.	Water Solubility	Melting/Flash Point (°C)	Health Hazard	Physical Hazard	pH
KCM027	Gray powder	2.88-3.08	Insoluble	>93	Eyes, inhalation	Dust	N/A

3. Chemical Properties and Application

KCM027 is an inorganic powder that can be added into regular Portland cement systems to improve both cement strength and chemical resistance to corrosive environment such as CO₂ and H₂S bearing formations. It not only reduces cement permeability to prevent the encroachment of corrosive fluids, but also reacts with extra lime in cement to improve the compressive strength of the cement.

Theoretically KCM027 can be used at any applicable cementing temperatures and densities due to its chemical and physical natures.

KCM027 is compatible with most cement additives and can be used in fresh, salt and seawater cement slurries.

4. Treatment

3-15%BWOC is generally required to have effective corrosion control and strength improvement depend on temperature, mixing water, and slurry density.

5. Packaging

KCM027 is supplied in 25kg plastic-lining sacks.

Flow-off Additive KCM028

1. Introduction

Gas migration control agents are generally used to prevent formation fluid migration from occurring. Flow-off technology which contains gas migration control agent KCM028 is specifically developed to form flow resistance to formation fluids so that the formation fluids cannot migrate during the transition period of cement hydration.

2. Physical Properties and Hazards

Additive	Form	S.G.	Flash Point (°C)	Health Hazard	Physical Hazard	pH
KCM028	White liquid	0.98-1.08	>93	Eyes, skin	None	6.0-8.0

3. Chemical Properties and Application

KCM028 can be used for cement slurry design at wide temperature (65-150°C) and density ranges (10.5-20lbs/gal) due to its unique chemical natures. It can be mixed with freshwater, seawater, and salt water depend on application requirement.

Together with stabilizer KCM018 and KCM018A, Flow-off additive KCM028 provides superior fluid migration control in cementing gas-bearing formations while maintaining proper rheological properties (PV 10-60cP/YP 1-10 lbs/100ft²), fluid loss control (less than 35mL), and accurate thickening time (1-10 hour adjustable).

Lower free water is generally expected for cement slurries containing KCM028. It is compatible with most cement additives and environmentally friendly.

4. Treatment

1.0-3.5 gal/sk loading is generally required for effective gas migration control depend on temperature, mixing water, and slurry density. Typically, higher the temperature, lower the density, and more KCM028 is required for effective gas migration control.

5. Packaging

This product is supplied in 53 gallons high density polyethylene (HDPE) drums.

Keep it away from extreme conditions such as places near flames or direct sunlight.

Defoamer and Anti-foaming Agent KCM043

1. Introduction

Foams formed while mixing cement slurry cause many problems such as lower and wrong density reading, poor particle wetting and hydration efficiency, and pumping difficulties due to pump cavitation and loss of suction. Defoamer or antifoaming agent is often required in cement slurry to avoid problems described above, especially for Latex Slurries.

2. Physical Properties and Hazards

Additives	Form	S.G. (20°C)	Water Solubility	Flash Point (°C)	Health Hazard	Physical Hazard	pH
KCM043	White emulsion	0.92-1.12	dispersible	>93	Eyes	None	6-8

3. Chemical Properties and Application

Due to its chemical nature and high content of active ingredient, KCM043 is an effective foam breaking agent in most cement slurries. It can also function as good foam preventer such as KCM003.

KCM043 has been found to be compatible with most additives in cement slurry design without density and temperature limitations. KCM043 is also very effective in latex gas migration control systems and salt-tolerant cement slurries especially in salt-saturated systems.

4. Treatment

0.01-0.05 gal/sack of cement is required in most cement slurry applications.

5. Packaging

This product is supplied in 5 gallons high density polyethylene (HDPE) pail.

Keep it away from extreme conditions such as places near flames or direct sunlight.